# Pesticide Use On Turfgrass in Ohio 2001

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# Abstract

A survey of pesticide use by commercial turfgrass pesticide applicators in three representative areas of Ohio was conducted. Names were collected from Ohio Department of Agriculture lists, and surveys were mailed to 1,290 pesticide applicators with 20.1% returned.

Approximately 65% of the respondents stated they applied pesticides and provided data, 27% did not apply pesticides, and 8% were duplicate surveys or did not provide data. Cumulatively, respondents managed 30,762 acres of different types of turfgrass, mostly residential and commercial.

Total quantities of active ingredients (A.I.'s) applied in 2001 were 112,848 lbs of herbicides, 10,598 lbs of insecticides, 4,796 lbs of fungicides, and 263 lbs of soil fumigants and plant growth regulators.

Herbicides were the most frequently applied pesticides (88% of total pounds), followed by insecticides (8%) and fungicides (4%). The mean quantity of pesticide A.I. applied was 4.2 lbs of A.I. per acre. The herbicide, insecticide, and fungicide A.I.'s applied in the largest quantities were 2,4-D, imidacloprid, and mancozeb, respectively.

In addition to applying pesticides, 92.2% of the respondents performed one to several other turfgrass maintenance activities such as mowing, irrigation, and aeration. The majority of the respondents (65.9%) stated they always used pesticides at the labeled rate. Approximately 61% of the respondents stopped spraying when wind velocity reached around 10 mph.

The most common type of pesticide application equipment used was a spreader for dry or granular materials. Of the different types of pesticide application equipment used, truck or trailer tank sprayers and dry spreaders were calibrated with the greatest frequency.

The top-rated source of information about pesticide application was the pesticide label, with the World Wide Web/Internet, trade magazines, and commercial newsletters ranking fairly low in the ratings.

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## Introduction

Pesticide-use data and adoption of Integrated Pest Management (IPM) practices are important indicators of how IPM programs are implemented. Much of the pesticide-use data collected in the past has centered on agricultural commodities and the relationship to food and water safety. However, as aggregate and cumulative pesticide exposure data become increasingly more important because of the Food Quality and Protection Act (FQPA), the need for pesticide-use information in urban settings, particularly on turfgrass, has increased.

In Ohio, pesticides are frequently used in turfgrass maintenance programs. Pesticide type, quantity , and pattern of use varies from site-to-site, depending on the needs of the turfgrass owner/manager. Some turfgrass owners/managers choose not to apply any pesticides. Other individuals may choose to select, purchase, and apply pesticides themselves.

Turfgrass pesticides are readily available through numerous retail outlets such as home improvement centers, lawn and garden stores, and department stores. Pesticides are marketed to residential turfgrass owners (i.e., the do-it-yourself homeowner) as stand-alone or as combination products such as weed-and-feed (herbicide and fertilizer) products, with few restrictions on their purchase and use. To assist customers, companies provide guides or programs with recommendations for proper product selection and application timing.

Labelling frequently reflects the order in which the products are recommended to be applied (e.g., Step 1, Step 2, etc.), as well as the time of year (e.g., "Winterizer fertilizer to be applied in late fall to prepare the turfgrass to over winter.").

Some of these products are formulated as liquid concentrates and/or dissolvable granuals applied through hose-end applicators, while others are formulated as granules applied through dry drop or cyclone spreaders. A third option is to contract with a professional turfgrass maintenance company that determines what, when, and where pesticides are needed, and how they are applied.

The primary purpose of this project was to collect pesticide-use information on turfgrass in metropolitian areas in the three different USDA defined agro-ecosystem regions of Ohio — the Eastern Uplands (southeastern Ohio), the North

ern Crescent (northern Ohio), and the Heartland (western and central Ohio) regions (USDA ERS 1999) by surveying turfgrass maintenance professionals and evaluating turfgrass pesticides available to the homeowner. Related questions on drift, calibration, and source of pesticide information were also included in the survey.

The information collected from this survey may be useful to Research and Extension personnel in assessing current pesticide use and future needs as well as in determining how turfgrass managers obtain pesticide information.

## Methods

To determine what pesticides potentially are being applied by do-it-yourselfers, four of the most common granular-based homeowner turfgrass management programs were reviewed to determime recommended mixtures and rates of active ingredients (A.I.'s). The rate of A.I. applied per acre was calculated using the percent A.I. analysis disclosure statement and the recommended application rate.

To determine the amount of pesticide used by commercial turfgrass pesticide applicators, a survey questionnaire was developed during the fall and winter of 2001 with input from Research and Extension specialists at The Ohio State University (see the Appendix). Turfgrass pesticide applicators for three Ohio agro-ecosystems were identified from the Ohio Department of Agriculture's listing of commercial pesticide applicators associated with the turf industry.

Surveys were mailed to 1,290 pesticide applicators in three regions of Ohio in late January 2002 (Table 1). In instances where surveys were sent to multiple individuals at the same company, it was requested that only one representative from a company return a completed survey. When multiple responses came from within a single company, only one of those responses was used in the data set. Non-respondents were contacted by follow-up mail and telephone communications.

Most of the survey respondents worked for turfgrass and landscape management companies located in 22 Ohio counties in and around major population centers, although several minor population centers and surrounding counties were surveyed in southeastern Ohio which has no major population center (Table 1). Data were collected, edited, checked for accuracy, and analyzed using standard statistical procedures.

## Results and Discussion

An analysis of the four most common do-it-yourself granular maintenance programs showed that the bulk of the product applied is fertilizer. Two or three products in each program are combinations of fertilizer plus pesticides, most of which are herbicides. Two herbicides are used in all four programs — 2,4-D applied at rates of 0.8 to 1.5 lbs A.I. per acre and mecoprop (mecoprop-P or MCPP) applied at rates of 0.4 to 0.8 lbs A.I. per acre (Table 2).

The herbicide pendimethalin, applied at a rate of 1.5 lbs A.I. per acre, is used in three of the programs, although one program includes dithiopyr at a rate of 0.25 lbs A.I. per acre as an alternative to pendimethalin. The herbicide dicamba (0.04 to 0.06 lb A.I. per acre) and the insecticide bifenthrin (0.1 lb A.I. per acre) are each

**Table 1. Counties and Population Centers Sampled in the Three Agro-Ecosystems of Ohio by the 2001 Ohio Turfgrass Pesticide Usage Survey.**

| Agro-Ecosystem Regions | Population Centers | Counties Included in Survey |
|---|---|---|
| Eastern Uplands (Southeastern Ohio) | Athens<br>Ironton<br>Marietta<br>Portsmouth | Athens<br>Lawrence<br>Scioto<br>Washington |
| Heartland (Western Ohio) | Columbus<br>Dayton<br>Springfield | Clark<br>Delaware<br>Fairfield<br>Franklin<br>Greene<br>Licking<br>Madison<br>Miami<br>Montgomery<br>Pickaway<br>Union |
| Northern Crescent (Northern Ohio) | Cleveland | Cuyahoga<br>Geauga<br>Lake<br>Lorain<br>Medina<br>Portage<br>Summit |

used in two programs. Dichlorprop (2,4-DP) (0.42 lb A.I. per acre), an herbicide, and diazinon (4.36 lbs A.I. per acre), an insecticide, as well as the dithiopyr mentioned previously are each used in one program.

If a do-it-yourselfer followed the entire recommended program, then the total pounds of A.I. applied per acre would range from 1.9 to 5.6 lbs, with an average of 4.0 lbs. Of the total pounds of pesticide A.I. applied per acre for the four programs reviewed, approximately 70% is herbicide and 30% is insecticide.

Each of the programs also markets alternative and/or additional products that can be substituted for a recommended product, or added onto the program (Table 3). Some of these products targeted a specific pest, such as white grubs, that are not covered by the base program. For example, one program did not include a pre-emergent annual weed grass control product, but two crabgrass control products were available, fertilizer plus dithiopyr and dithiopyr alone, both with labels very similar in appearance to the base program products.

Also available at most retail stores were three different white grub control products containing the pesticide dylox (trichlorfon), halofenozide, or imidacloprid (Table 3). Three programs had an alternative

## Table 2. Turfgrass Management Products Available Through Retail Outlets That Are Marketed as Season-Long Programs.

Pesticide products are listed by program and approximate time of year for application, and include general product composition, active ingredients (A.I.), and application rates when available.

| Time of Application | Product Type(s)* | Pesticide Active Ingredient | Application Rate (Lb(s) A.I. /A) |
|---|---|---|---|
| **Program 1** | | | |
| Spring | F,H | 2,4-D<br>Mecoprop-P<br>Dicamba | 0.77<br>0.38<br>0.04 |
| Summer | F,I | Diazinon | 4.36 |
| Fall | F | None | 0.0 |
| Late Fall | F | None | 0.0 |
| **Total** | | | **5.55** |
| **Program 2** | | | |
| Early Spring | F,H | Pendimethalin | 1.5 |
| Early Summer | F,H | 2,4-D<br>Mecoprop-P<br>Dicamba | 1.5<br>0.75<br>0.06 |
| Summer | F,I | Bifenthrin | 0.1 |
| Fall | F | None | 0.0 |
| **Total** | | | **3.91** |
| **Program 3** | | | |
| Early Spring | F,H<br>or<br>F,H | Pendimethalin<br>or<br>Dithiopyr | 1.5<br>or<br>0.25 |
| Early Summer | F,H | 2,4-D<br>MCPP<br>Dichlorprop(2,4-DP | 0.8<br>0.42<br>0.42 |
| Summer | F | None | 0.0 |
| Fall | F | None | 0.0 |
| **Total** | | | **3.14<br>or<br>1.89** |
| **Program 4** | | | |
| Early Spring | F,H | Pendimethalin | 1.5 |
| Early Summer | F,H | 2,4-D<br>Mecoprop-P | 1.5<br>0.76 |
| Summer | F,I | Bifenthrin | 0.1 |
| Fall | F | None | 0.0 |
| **Total** | | | **3.86** |

* F = Fertilizer; H = Herbicide; I = Insecticide. Products with pairs of letters are combination products.

**Table 3. Additional and Alternative Turfgrass Management Products Available Through Retail Outlets That Are Marketed for Incorporation into Season-Long Programs.**

Pesticide products are listed by program and approximate time of year for application, and include general product composition, active ingredients (A.I.), and application rates when available.

| Time of Application | Product Type(s)* | Pesticide Active Ingredient | Application Rate (Lb(s) A.I./A) |
|---|---|---|---|
| **Program 1** | | | |
| Early Spring | F,H | Dithiopyr | 0.25 |
| | or | or | |
| | H | Dithiopyr | 0.25 |
| Late Fall | F,H | 2,4-D | 0.77 |
| | | Mecoprop-P | 0.38 |
| | | Dicamba | 0.04 |
| **Program 3** | | | |
| Fall | F,H | 2,4-D | 0.8 |
| | | MCPP | 0.42 |
| | | Dichlorprop(2,4-DP) | 0.42 |
| **Program 4** | | | |
| Fall | F,H | 2,4-D | 1.5 |
| | | Mecoprop-P | 0.76 |
| **White Grub Control Products** | | | |
| Spring or Fall | I | Dylox(Trichlorfon) | 8.1 |
| Late Spring through Mid-Summer | I | Halofenozide | 1.5 |
| Late Spring through Mid-Summer | I | Imidachloprid | 0.26 |
| Late Spring through Mid-Summer | F,I | Imidachloprid | 0.33 |

* F = Fertilizer; H = Herbicide; I = Insecticide. Products with pairs of letters are combination products.

choice which contained broadleaf herbicides for their "winterizer" fertilizer product.

From an IPM perspective, it is good that these products are offered as alternatives and add-ons rather than being a standard part of all programs. It gives the do-it-yourself turfgrass manager the option to apply these products only when and where they are needed.

However, the availability of the extra products also may encourage the do-it-yourselfer to use greater quantities of pesticides than necessary. As an example, a person using the standard products of Program 4 (Table 2) on one acre of turfgrass would apply a total of 3.86 lbs of pesticide (1.5 lbs pendimethalin for crabgrass in early spring, 1.5 lbs 2,4-D and 0.76 lb mecoprop-P for broadleaf weeds in early summer, and 0.1 lb bifenthrin for surface-feeding insects in summer).

By adding a white grub control product (1.5 lbs halofenozide) in late spring through mid-summer, and substituting the alternative "winterizer" weed and feed product in the fall (1.5 lbs 2,4-D and 0.76

lb mecoprop-P for broadleaf weed control) (Table 3), the amount of pesticide A.I./acre would rise to 7.62 lbs, nearly twice the amount from the unaltered Program 4. Depending on the program and products chosen, the total pounds of pesticide A.I. used could be as high as 15.1 lbs per acre.

Of the 1,290 initial surveys sent to turfgrass pesticide applicators, 36.8% went to more than one individual within a single company. Thus, there were a maximum number of 815 possible surveys that could be returned with unduplicated data from different individuals and/or companies.

A total of 259 surveys were returned which represents 20.1% of the original quantity of surveys distributed. Seventeen surveys were duplicates from the same company and were eliminated from any further consideration or inclusion in the data set.

Based on the responses to several of the questions on the survey, the respondents mostly represent small- to medium-sized, independent lawn-care companies in Ohio.

Table 4 shows the classification of the returned surveys based on type of response. Seventy survey respondents (27%) indicated they applied no pesticides to turfgrass in 2001, even though they maintained a current license to do so. Some reasons for this practice obtained through telephone communications with the respondents included:

1. They were structural pest-control operators with concerns about the legalities of applying pesticides to control nuisance pests, such as ants, that may be living in turfgrass.

2. They were pesticide applicators who had left the turfgrass management business but might return and did not want to let their license expire.

There were 167 surveys returned with usable pesticide-use data and five surveys returned with the response of "Yes, pesti

**Table 4. Numbers of Surveys Distributed and Returned from the Sampled Areas, Classification of Surveys Based on Type of Response, and Percentages of Returned Surveys With Usable Pesticide-Use Data in the 2001 Ohio Turfgrass Pesticide Usage Survey.**

| Survey Area | Surveys | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Distributed | Returned | | Yes; Applied Pesticides in 2001 | | | | No; Did Not Apply Pesticides in 2001 | |
| | | | | Provided Pesticide Use Data | | Did Not Provide Pesticide Use Data | | | |
| | Number | Number | Percentage (%) | Number | Percentage (%) | Number | Percentage (%) | Number | Percentage (%) |
| Southeast | 30 | 9 | 30.0 | 6 | 66.7 | 0 | 0 | 3 | 33.3 |
| Columbus | 434 | 74 | 17.1 | 51 | 68.9 | 1 | 1.4 | 19 | 25.7 |
| Dayton/ Springfield | 226 | 49 | 21.7 | 29 | 59.2 | 1 | 2.0 | 14 | 28.6 |
| Cleveland | 600 | 127 | 21.2 | 81 | 63.8 | 3 | 2.4 | 34 | 26.8 |
| Total | 1,290 | 259 | 20.1 | 167 | 64.5 | 5 | 1.9 | 70 | 27.0 |

cides were applied to turfgrass in 2001," but with no pesticide-use data.

The turfgrass managers were asked to identify the types of turfgrass areas to which pesticide applications were made in 2001 from among six choices. The six choices were:

- Golf course
- Residential [home]
- Commercial/business [condominium, apartment building, office building, etc.]
- School turf areas/athletic fields
- Public turf/park areas
- Other.

Most of the respondents indicated that they applied pesticides to residential or commercial/business lawns or a combination of the two types (68.5% and 56%, respectively). The other types of turfgrass areas were treated much less frequently by the respondents (Table 5).

The respondents reported that they treated a total of 30,762 acres of turfgrass. Of this total, 27,018 acres (87.8%) was lawn located around a home or commercial building (Table 5).

A total of 128,504 lbs of pesticide A.I. was applied by the 167 respondents in 2001, including 112,848 lbs of herbicides (87.8%), 10,598 lbs of insecticides (8.3%), 4,796 lbs of fungicides (3.7%), and 263 lbs of soil fumigants and plant growth regulators (0.2%) (Table 6). A mean of 4.2 lbs of pesticides was applied per acre, which was similar to the do-it-yourself programs (4.0 lbs/A).

## Herbicides

Herbicides represented 87.6% of the total lbs of pesticide A.I. applied including 29 different A.I.'s applied singularly or in combinations (Table 7). The frequency of use by respondents ranged from <1% to 89.2%. Table 7 lists 16 commonly used herbicide A.I.'s. Of the 16, six herbicides were used by approximately 40% of the turfgrass managers surveyed.

The most frequently used herbicide was 2,4-D (amine and ester forms), with 89.2% of respondents having used it. The other four frequently used herbicides were

**Table 5. Classification of Turfgrass Types Managed, Percentage of Respondents Managing Each Type, Number of Acres, and Percentage of Total Acreage Reported in the 2001 Ohio Turfgrass Pesticide Usage Survey.**

| Turfgrass Type | Respondents Managing Turfgrass Type (%) | Acres Reported (Number) | Total Acreage (%) |
|---|---|---|---|
| Golf Course | 4.2 | 550 | 1.8 |
| Residential Lawn | 68.5 | 16,593 | 53.9 |
| Commercial/Business Lawn | 56.0 | 10,425 | 33.9 |
| School Turfgrass/Athletic Fields | 10.1 | 777 | 2.5 |
| Public Turfgrass/Park Areas | 6.6 | 376 | 1.2 |
| Other | 4.2 | 2,041 | 6.6 |

**Table 6. Quantities of Different Types of Pesticide Active Ingredients That Were Reported as Used by Respondents to the 2001 Ohio Turfgrass Pesticide Use Survey.**

| Chemical Type | Pounds of Active Ingredient (A.I.) Used | Percentage of Total A.I. | Mean Pounds of A.I. Per Acre |
|---|---|---|---|
| Fungicides | 4,796 | 3.7 | 0.2 |
| Herbicides | 112,708 | 87.8 | 3.7 |
| Insecticides | 10,598 | 8.3 | 0.3 |
| Other[a] | 263 | 0.2 | 0.009 |
| Total | 128,365 | 100.0 | 4.2 |

[a] The chemical type category Other is composed of plant growth regulators and soil fumigants.

dicamba, mecoprop (MCPP or mecoprop-P), pendimethalin, clopyralid and triclopyr, used by 75.9%, 68.1%, 48.2%, 45.2%, and 39.8% of respondents, respectively.

Five of these herbicides are often used in combination for broadleaf weed control and are found in numerous manufacturers' products. The exception is pendimethalin, which is used for crabgrass control and is not combined with other herbicides.

Quantities of each herbicide used ranged from 0.4 to 36,713 lbs (Table 7). For eight of the 16 herbicides listed in Table 7, more than 1,500 pounds of A.I. were used, including six of the eight herbicides used most frequently — 2,4-D, dicamba, mecoprop, pendimethalin, clopyralid, and triclopyr. The most commonly used herbicide was 2,4-D with 36,713 lbs of A.I. (32.6% of all herbicides and 28.5% of all pesticide A.I.'s), followed by mecoprop (21,789 lbs), pendimethalin (15,584 lbs), dicamba (5,194 lbs), triclopyr (1,540 lbs), and clopyralid (1,428 lbs).

Two additional herbicides used in large quantities were MCPA and glyphosate. MCPA was used by only 7.8% of respondents, but two respondents collectively applied 22,154 lbs of MCPA in 2001, skewing the results. This quantity represents 20% of all herbicide A.I.'s used, and 17.2% of all pesticide A.I.'s used in 2001. Glyphosate was used by 24.1% of the respondents to prepare lawns for installation and renovation, with a total of 2,090 lbs A.I. applied.

The continued use of clopyralid and 2,4-D, two of the most commonly used herbicides on residential turfgrass, may and will decline in the future due to concerns about impacts on non-target plants and animals. Their use decline will result in increased usage of other herbicide A.I.'s, which can explain the quantities of MCPA used by two of the larger turfgrass managers responding to the survey.

Clopyralid is being removed from the residential turfgrass market because of carry over of the A.I. into vegetable and flower gardens in compost mulch (http://cahenews.wsu.edu/RELEASES/2001/01035.htm) (Caldwell 2001) (http://www.dowagro.com/newsroom/news/041102.htm) (Heine 2002).

The clopyralid is placed on compost piles in grass clippings from lawns treated with herbicides containing clopyralid. The clo

**Table 7. 2001 Ohio Turfgrass Pesticide Use Report by Active Ingredient (A.I.) — Pesticide Type, Herbicide, and Minor-Use Herbicide.**

| Active Ingredient (A.I.) | Applicators Who Used A.I. (%) | A.I. Used (lbs) | Total Pounds of A.I. Used (%) | Mean Pounds of A.I. Used Per Acre (lbs/A) |
|---|---|---|---|---|
| 2,4-D | 89.2% | 36,713.1 | 28.4% | 2.001 |
| Benefin | 16.9% | 1,112.3 | 0.9% | 0.777 |
| Clopyralid | 45.2% | 1,428.4 | 1.1% | 0.112 |
| Dicamba | 75.9% | 5,194.4 | 4.0% | 0.256 |
| Dichlorprop | 6.6% | 333.0 | 0.3% | 2.425 |
| Dithoipyr | 25.3% | 621.9 | 0.5% | 0.197 |
| Glyphosate | 24.1% | 2,088.8 | 1.6% | 2.289 |
| MCPA | 7.8% | 23,384.4 | 18.1% | 0.814 |
| MCPP | 68.1% | 21,789.3 | 16.9% | 1.213 |
| MSMA | 5.4% | 176.4 | 0.1% | 1.542 |
| Pelargonic Acid | 3.0% | 105.0 | 0.1% | 1.055 |
| Pendimethalin | 48.2% | 15,584.4 | 12.1% | 1.7 |
| Picloram | <1.0% | 300.0 | 0.2% | 0.250 |
| Prodiamine | 1.2% | 1,110.9 | 0.2% | 0.250 |
| Triclopyr | 39.8% | 1,540.0 | 1.2% | 0.181 |
| Triflualin | 21.7% | 1,130.9 | 0.9% | 0.830 |
| **Minor-Use Herbicides** | | | | |
| Bensulide | <1.0% | 10.0 | <0.1% | 0.641 |
| Bentazon | <1.0% | 2.5 | <0.1% | 0.608 |
| Diuron | <1.0% | 12.4 | <0.1% | 1.556 |
| Fenozaprop-P-Ethyl | 2.4% | 0.4 | <0.1% | 0.016 |
| Glufosonate | <1.0% | 0.4 | <0.1% | 0.046 |
| Halosulfuron | 5.4% | 2.3 | <0.1% | 0.002 |
| Imazapic | <1.0% | 0.4 | <0.1% | 0.259 |
| Imazapyr | <1.0% | 1.6 | <0.1% | 0.195 |
| Isoxaben | 3.0% | 7.6 | <0.1% | 0.215 |
| Methanearsonate | <1.0% | 0.7 | <0.1% | 0.131 |
| Metsulfuron methyl | 1.2% | 22.6 | <0.1% | 0.043 |
| Bensulide | <1.0% | 10.0 | <0.1% | 0.641 |
| Bentazon | <1.0% | 2.5 | <0.1% | 0.608 |

pyralid is not completely breaking down in the compost pile and when the contaminated compost is applied to garden beds, non-target plants are being injured or killed. As a result of these problems, the registration for usage of clopyralid on residential turfgrass is being cancelled.

One of the most widely used agricultural herbicides, 2,4-D is also one of the most widely used lawn-care herbicides in the United States. It was a common A.I. in all the do-it-yourself programs reviewed for this report (Table 2), and it was also the most commonly used herbicide A.I. and the herbicide A.I. used in the greatest quantity as reported in the survey.

The popularity of the 2,4-D herbicide is due to its effectiveness and relative low cost to use. However, its popularity and frequency of use makes 2,4-D a target of concerns about over use and over exposure of the public.

Concerns about pesticide use are understandable and should be investigated. These concerns are further fueled by statements in the news media about the potential effects of pesticides on human and animal health. The continued widespread use of 2,4-D has been a subject of debate since 1991 when a controversial study was published that purportedly showed a positive association between canine malignant lymphoma and the use of 2,4-D by the dogs' owners (Hayes *et al.*, 1991). Anti-pesticide-use activists groups have used the results of this study as evidence to support their contention that 2,4-D use is also related to the development of non-Hodgkin's lymphoma in humans. Numerous studies dispute these conclusions; however, the concerns over the use of 2,4-D persist among the public. In response to these concerns, at least one of the largest national lawn-care companies has replaced 2,4-D in its broadleaf management programs with the herbicide A.I. MCPA (personal communication).

Of the respondents to the survey, most are still regularly using 2,4-D. However, two respondents who manage fairly large quantities of turfgrass had also removed 2,4-D from their programs and substituted MCPA. As a result, MCPA was the second greatest quantity of herbicide A.I. used by respondents to the survey even though its frequency of use was relatively low.

Thirteen herbicides were used in total quantities of less than 40 lbs (Table 7). For this report, these herbicides are being classified as minor-use herbicides. Most of the minor-use herbicides were used by less than 1% of the respondents, and each accounted for less than 0.1% of all the pesticide A.I.'s reported. Many of these products were used for spot treatments only.

To assess how turfgrass managers are using pesticides on turfgrass, the survey asked respondents to provide examples of typical pest-control programs used in 2001, including products used and rates of application. Pesticide usage was further evaluated by associating the information provided in these examples with reported numbers of acres managed and products and quantities used (see Appendix, Survey Questions No. 2 and No. 3, respectively).

For example, the manufacturer's recommended rates of application for pendimethalin (a pre-emergent annual grass herbicide) on northern turfgrasses are 1.5 lbs to 2.0 lbs A.I. per acre for an initial application prior to weed germination in the spring, and a possible repeat appli

cation of 1.0 lbs to 2.0 lbs A.I. per acre after a minimum of four to five weeks for extended weed control or where heavy weed infestations are expected (C&P Press 1996, 1999; C&P Press Web site 2001, 2002).

Thus, a turfgrass manager could apply anywhere from 1.5 lbs A.I. per acre or less with a single application to 3.5 lbs A.I. per acre with two applications at maximum label rates. Pendimethalin was used by 48% of respondents in 2001, with a total of 15,687 lbs of A.I. applied to 22,450 acres, or 73% of all acres reported.

Based on reported quantities used and application rates, 15,687 lbs of pendimethalin A.I. were applied to 9,183 acres, for an average of 1.7 lbs A.I. per acre. This amount is within the total annual recommended use rates for pendimethalin and is only 0.2 lbs A.I. per acre higher than the recommended single application rate.

The percentage of acres treated with pendimethalin by an individual applicator ranged from <1% to 360% (values exceed 100% when more than one application is made to the same area), with 96% of applicators falling between <1% and 150% and 71% between <1% and 100%. Three respondents treated substantially more acreage than the other 77 respondents with 213%, 344%, and 360% of their acres treated, respectively. However, the values may not be accurate. It appears errors may have been made either in reporting formulation of product used or number of acres treated.

The applicator reporting 213% of acres treated may have misreported the formulation used, as no corresponding label could be found, and other applicators used the same product and reported a different formulation. The reports of 344% and 360% of acreage treated by respondents may have resulted from misreporting the numbers of acres managed. In both cases, several products, including pendimethalin, that would normally be used as blanket treatments to all acreage, were reported in quantities great enough to treat areas two to three times larger than that reported. Thus, there were reasons to believe these data were suspect values, and they were deleted from the data set.

Applicators applied less than half the amount of pendimethalin they could have based on labeled rates, and less than five times the amount they could have if they treated all acres under their management, suggesting that this pesticide is used fairly conservatively.

Several of the respondents also included statements about their IPM practices including:

1. Selective applications — pendimethalin was only applied in sunny areas of turfgrass, avoiding shady areas where annual grass weeds would not be a problem.

2. Timing of applications — soil temperatures or plant phenology were used as guides to determine when to make applications.

3. Rotation of products on an annual basis to avoid development of pesticide resistance.

4. Use of reduced rates coupled with mowing turfgrass high to promote weed suppression by shading to reduce weed seed germination.

## Insecticides

Of all pesticides applied, 10,599 lbs (8.2% of the total) were insecticides, including 13 different A.I.'s (Table 8). Frequency of use of the insecticides by the turfgrass managers ranged from <1 to 41% of those replying to the survey. Table 8 lists seven commonly used insecticide A.I.'s, of which three were used by approximately 20% or more of the turfgrass managers surveyed.

The most frequently used insecticide was imidacloprid with 41% of the respondents having used it. The two other most frequently used insecticides were chlorpyrifos and trichlorfon, used by 20.5% and 19.3% respectively.

Quantities of each A.I. used ranged from 11 to 4,542 lbs (Table 8), including 4,542 lbs of trichlorfon, 2,654 lbs of chlorpyrifos, and 1,573 lbs of imidacloprid. Although respondents used a smaller quantity of imidacloprid than chlorpyrifos or trichlorfon, imidacloprid was used on a greater number of acres.

The 1,573 lbs of imidacloprid reported would be enough to treat approximately 5,242 acres of turfgrass at the lowest labeled rate of 0.3 lbs A.I. per acre, or 3,932 acres at the highest labeled rate of 0.4 lbs A.I. per acre. The amount of chlorpyrifos reported used would treat 2,654 acres at the low rate of 1 lb of A.I. per acre, or 663 acres at the high rate of 4 lbs A.I. per acre. And the amount of trichlorfon reported used would treat approximately 841 acres at the low rate of 5.4 lbs of A.I. per acre or 561 acres at the high rate of 8.1 lbs per acre.

Assuming that all three of these insecticides were used on different areas, the

**Table 8. Ohio Turfgrass Pesticide Use Report for 2001 by Active Ingredient (A.I.) — Pesticide Type, Insecticide, and Minor-Use Insecticide.**

| Active Ingredient (A.I.) | Applicators Who Used A.I. (%) | A.I. Used (lbs) | Total Pounds of A.I. Used (%) | Mean Pounds of A.I. Used Per Acre (lbs/A) |
|---|---|---|---|---|
| Bifenthrin | 0.9% | 147.5 | 0.1% | 0.038 |
| Carbaryl | 3.0% | 333.0 | 0.3% | 1.303 |
| Chlorpyrifos | 20.5% | 2,654.0 | 2.1% | 0.952 |
| Diazinon | 7.8% | 347.8 | 0.3% | 1.404 |
| Halofenozide | 9.0% | 696.0 | 0.5% | 0.305 |
| Imidacloprid | 41.0% | 1,572.7 | 1.2% | 0.101 |
| Trichlorfon | 19.3% | 4,542.3 | 3.5% | 0.775 |
| **Minor-Use Insecticides** | | | | |
| Acephate | <1.0% | 54.0 | <0.1% | 0.012 |
| Bifenazate | <1.0% | 11.0 | <0.1% | 0.002 |
| Cyfluthrin | <1.0% | 11.0 | <0.1% | 0.002 |
| Deltamethrin | 4.8% | 48.8 | <0.1% | 0.203 |
| Oftanol | <1.0% | 140.0 | <0.1% | 0.031 |
| Permethrin | 3.6% | 39.6 | <0.1% | 0.356 |

maximum number of acres that could have been treated using all three materials at their lowest labeled rate would have been 8,737 acres, or 28.4% of the acreage reported. Chlorpyrifos, imidacloprid, and trichlorfon account for 82.7% of the total pounds of insecticide reported. Thus, one can conclude that respondents treated less than 30% of the turfgrass acreage under their management with any type of insecticide.

The six insecticides used in quantities of 140 pounds or less (Table 8) are classified as minor-use insecticides for this report. Most of these minor-use insecticides were used by less than 1% of the respondents, and each accounted for less than 0.1% of all the pesticide A.I.'s reported. Many of these products were used for spot treatments only.

## Fungicides

Fourteen different fungicides were applied in a quantity of 4,796 lbs, representing 3.7% of the overall total pounds of A.I. applied (Table 9). Frequency of use ranged from <1 to 5.4%, with none of the fungicides used by more than 5.5% of the respondents. Quantities of each fungicide used ranged from 0.3 lbs to 2,022 lbs (Table 9). Three of the fungicides listed in Table 8 were used in quantities of approximately 700 pounds of A.I. or more, including 2,022 lbs of mancozeb, 1,526 lbs of chlorothalonil, and 686 lbs of PNCB.

The seven fungicides used by respondents in quantities of 44 lbs or less (Table 9) are classified as minor-use fungicides for this report. Most of the minor-use fungicides were used by less than 3% of the respondents, and each accounted for less than

**Table 9. Ohio Turfgrass Pesticide Use Report for 2001 by Active Ingredient (A.I.) — Pesticide Type, Fungicide, and Minor-Use Fungicide.**

| Active Ingredient (A.I.) | Applicators Who Used A.I. (%) | A.I. Used (lbs) | Total Pounds of A.I. Used (%) | Mean Pounds of A.I. Used Per Acre (lbs/A) |
|---|---|---|---|---|
| Chlorothalonil | 5.4% | 1,525.7 | 1.2% | 6.892 |
| Iprodione | 1.8% | 108.9 | 0.1% | 0.009 |
| Mancozeb | 2.4% | 2,022.0 | 1.6% | 5.814 |
| Myclobutanil | 3.0% | 135.6 | 0.1% | 0.034 |
| PNCB | 3.6% | 686.3 | 0.5% | 11.0 |
| Propiconazole | 3.0% | 143.4 | 0.1% | 0.040 |
| Triadimefon | 5.4% | 106.7 | 0.1% | 0.894 |
| **Minor-Use Fungicides** | | | | |
| Aluminum Tris | <1.0% | 0.3 | <0.1% | 0.009 |
| Fenarimol | 2.4% | 4.3 | <0.1% | 0.015 |
| Mefenoxam | 1.2% | 43.1 | <0.1% | 0.215 |
| Metalaxyl | <1.0% | 1.4 | <0.1% | 0.038 |
| Thiophanate-methyl | 3.0% | 16.4 | <0.1% | 0.312 |
| Trifloxystrobin | <1.0% | 1.0 | <0.1% | 0.004 |
| Vinclozolin | <1.0% | 1.1 | <0.1% | 0.063 |

0.1% of all the pesticide A.I.'s reported. Based on the quantities reported, fungicides were used on very limited acreage.

In addition to herbicides, insecticides, and fungicides, use of three other chemicals was reported, including dazomet, a soil fumigant used by two researchers to prepare research plots, and the plant-growth regulators mefluidide and trinexapac-ethyl used by two commercial applicators (Table 10). Both commercial applicators managed residential and commercial turfgrass, and one also managed school turfgrass and athletic fields.

## Other Survey Results

In addition to pesticide application, respondents were asked if they performed other turfgrass maintenance activities. Of the respondents, 154 (92.2%) reported one to several other maintenance activities, including core aeration (83.8%), mowing (71.3%), lawn renovation (65.3%), lawn installation (50.9%), dethatching (34.1%), and irrigation (22.2%). Nine respondents (5.4%) did not perform any other maintenance activities, and four respondents (2.4%) did not answer the question.

Most of the respondents visit turfgrass sites throughout the season to perform tasks other than the pesticide application, creating opportunities to evaluate (scout) turfgrass several times throughout the season as part of an integrated pest management program.

The majority of respondents (65.9%) stated they always used pesticides at the labeled rate; a small portion (4.2%) always applied pesticides at less than the label rate; 25.2% sometimes applied pesticides at less than the label rate; and 4.8% admitted to sometimes applying pesticides at more than the labeled rate. No respondents reported to have always applied pesticides at more than the labeled rate.

Pesticide drift on windy days is a major concern throughout the pesticide application industry. Accordingly, the great majority of the applicators (97%) reported that they ceased pesticide application at some threshold of wind velocity between 1 and 25 mph, while 3% stated they did not have to stop because they only used dry granular materials or only sprayed when the wind was not blowing.

Approximately 61% of the applicators set their threshold wind velocity to stop

**Table 10. Ohio Turfgrass Pesticide Use Report for 2001 by Active Ingredient (A.I.) — Pesticide Type, Other.**

| Active Ingredient (A.I.) | Applicators Who Used A.I. (%) | A.I. Used (lbs) | Total Pounds of A.I. Used (%) | Mean Pounds of A.I. Used Per Acre (lbs/A) |
|---|---|---|---|---|
| Dazomet | 1.2% | 262.4 | 0.2% | 6.363 |
| Trinexapac-ethyl | <1.0% | 0.4 | <0.1% | 0.024 |
| Mefluidide | <1.0% | 0.2 | <0.1% | 0.010 |

spraying at 10 mph or less, with 20% at 5 mph, 41.2% at 10 mph, and 24.2% at 15 mph.

Respondents reported that television, radio, and local weather forecasts from the internet were the main sources of their wind velocity data. Most also indicated they did not measure wind velocity at the site of application, but used individual judgment based on personal experience, observed movement on trees and shrubs, and observed changes in spray patterns including development of mists and direct observation of drift. Twelve respondents (7.2%) did measure wind speed at the site of application using a hand-held anemometer.

The most common type of pesticide application equipment used by 91% of respondents was a spreader for dry or granular materials, with no distinction made between drop and cyclone spreaders. Other types of equipment were less frequently used, including truck or trailer sprayers (66.9%), hand pump sprayers (62.1%), back-pack sprayers (60.9%), and other types of application equipment (11.8%).

Truck or trailer tank sprayers and dry spreaders were calibrated with the greatest frequency, with the majority of the truck/trailer tank sprayers (55.8%) and dry spreaders (64.9%) calibrated at least four times a year. All of the truck/trailer tank sprayers and 93.4% of the dry spreaders were calibrated at least one time per year. The least frequently calibrated pieces of pesticide application equipment were hand-pump sprayers with 44.8% calibrated one to three times per year and 23.8% not calibrated at all. Backpack sprayers were also calibrated infrequently, with 59.2% being calibrated one to three times per year and 12.6% not calibrated at all.

Calibration is necessary to assure proper application rates, limit exposure to pesticides, reduce the chances of perceived pesticide failure, and reduce potential environmental risk and/or damage. Therefore, pesticide education programs need to continue to emphasize the importance of equipment calibration and to offer training on how to calibrate equipment properly.

The respondents to the survey were asked to rate the value of 12 different sources of information about pesticide applications (see Appendix, Survey Question No. 11). The response rate to each source of information ranged from 74.3% to 96.1% (Figure 1). Information sources were rated on a scale of 1 — Not Valuable to 5 — Extremely Valuable.

The top-rated source of pesticide application information was the pesticide label (Figure 2). Four other sources were also rated fairly high, including individual consultation with the pesticide/fertilizer dealer, Extension Service pesticide training sessions, Extension bulletins and fact sheets, and professional conferences (Figure 2). The lowest rated sources of pesticide application information were trade magazines, commercial newsletters, and the World Wide Web/Internet.

Apparently, applicators have not yet developed a reliance on the Internet for information, or the content needed to satisfy the applicators' needs is not yet available or is to hard to find. Only 20 respondents (11.2%) cited their own source

*Text continues on page 24.*

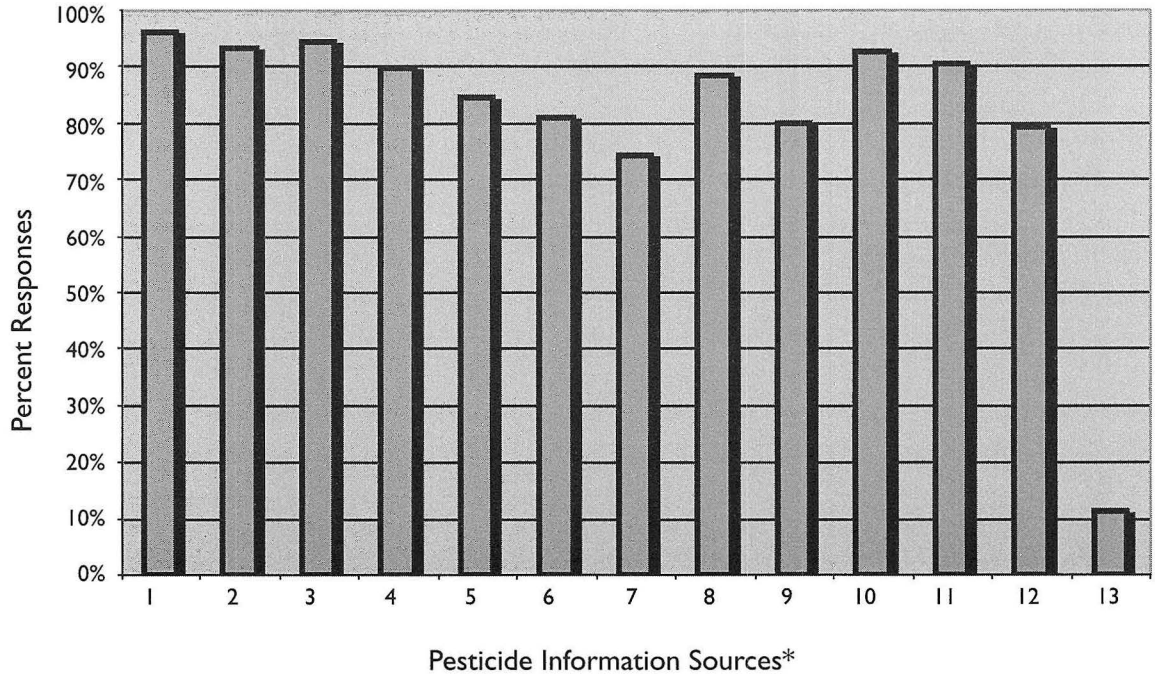


Figure 1. Percent of respondents (n = 179) who gave a rating to each source of information about pesticide applications presented in the 2001 turfgrass pesticide usage survey for Ohio.

* Pesticide Information Sources: 1 — Pesticide label (n = 172); 2 — Individual consultation with pesticide/fertilizer dealer (n = 167); 3 — Extension Service pesticide training sessions (n = 169); 4 — Extension Service bulletins and fact sheets (n = 161); 5 — Professional conferences (n = 151); 6 — Extension Service field days (n = 145); 7 — PEST newsletter (n = 133); 8 — Trade shows/field days (n = 158); 9 — Buckeye Yard and Garden Line (B.Y.G.L.) newsletter (n = 143); 10 — Trade magazines (n = 166); 11 — Commercial Newsletters (n = 162); 12 — The World Wide Web/Internet (n = 142); and 13 — Other named sources (n = 20).

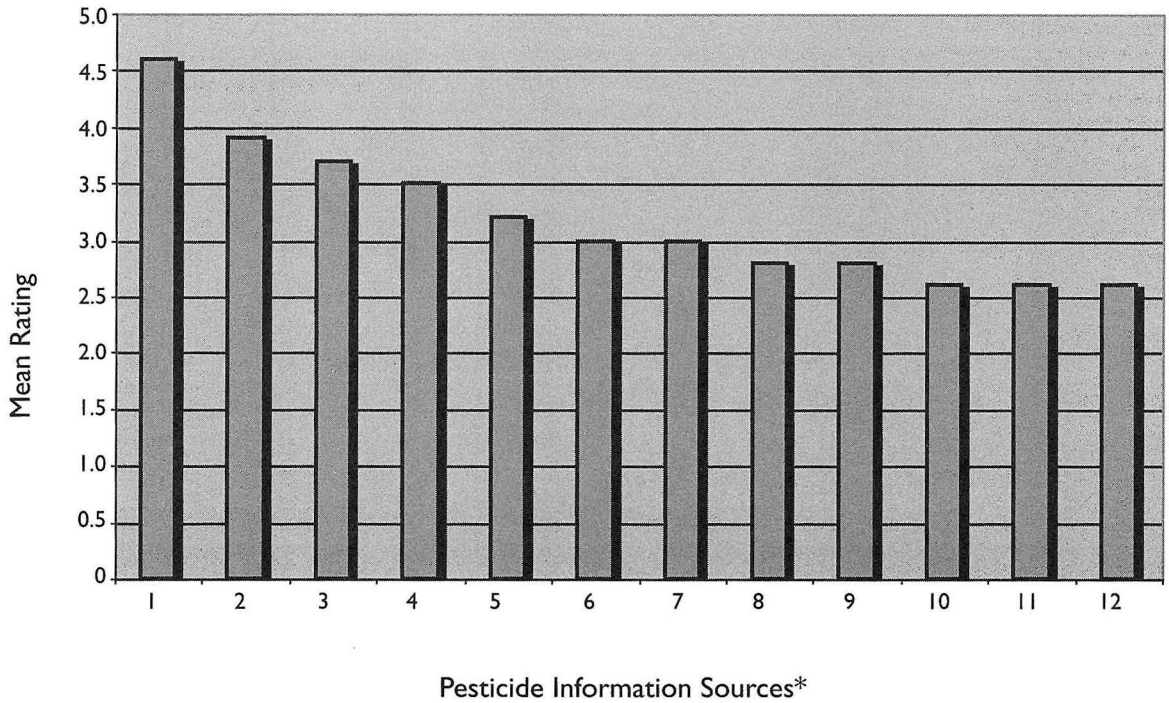


Figure 2. The value given to different sources of information about pesticide applications rated on a scale of 1 (not valuable) to 5 (extremely valuable) by respondents to the 2001 turfgrass pesticide usage survey for Ohio.

* Rating Scale: 1 — Not Valuable; 2 — Somewhat Valuable; 3 — Valuable; 4 — Very Valuable; 5 — Extremely Valuable.

** Information Sources: 1 — Pesticide label; 2 — Individual consultation with pesticide/fertilizer dealer; 3 — Extension Service pesticide training sessions; 4 — Extension Service bulletins and fact sheets; 5 — Professional conferences; 6 — Extension Service field days; 7 — P.E.S.T. newsletter; 8 — Trade shows/field days; 9 — Buckeye Yard and Garden Line (BYGL) newsletter; 10 — Trade magazines; 11 — Commercial Newsletters; and 12 — The World Wide Web/Internet.

of information about pesticide applications, which included: personal experience (6), other applicators (6), schooling (1), training by company (1), ODA (Ohio Department of Agriculture) (1), professional associations (1), customer (1), any other form of information (1), and sources that fit into other categories cited in the question (2).

In summary, some 65% of the respondents applied pesticides and provided data, 27% of the respondents stated they did not apply pesticides, and 8% were either duplicate surveys or did not provide data. Cumulatively, the respondents managed 30,762 acres of turfgrass, mostly residential and commercial. Herbicides were the most frequently applied pesticides (88% of total lbs of A.I.), followed by insecticides (8%), and fungicides (4%).

The largest quantities of herbicide, insecticide, and fungicide A.I.'s applied were 2,4-D, imidacloprid, and mancozeb, respectively. In addition to applying pesticides and/or pesticide/fertilizer combinations, 92.2% of the respondents performed one to several other maintenance activities, such as mowing and aeration.

The majority of the respondents (65.9%) stated that they always used pesticides at the labeled rate, a response that was validated in the evaluation of the survey data. Approximately 85% of the respondents claimed to have ceased spraying when wind velocity reached about 10 mph.

The most common type of application equipment used was a spreader for dry or granular materials. Of the different types of pesticide application equipment used, truck or trailer tank sprayers and dry spreaders were calibrated most frequently. The top-rated source of information about pesticide application was the pesticide label. Fairly low in the ratings were the World Wide Web/Internet, trade magazines, and commercial newsletters.

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# Appendix

## Survey cover letter for the 2001 Turfgrass Pesticide Usage Survey for Ohio

**Please update label information above** *if incorrect or incomplete* **and**
**RETURN this letter with the completed survey.**

*This cover letter will be separated from the survey once it has been returned.*

Dear Lawn Care Professional or Turfgrass Manager,

The use of pesticide products is essential to the production and maintenance of healthy turfgrass and the bene ts provided by healthy turfgrass. However, there are governmental and public concerns about pesticide use: food, water, worker, personal, child, pet, environmental, and wildlife, including endangered species, safety, and protection. Much of the pesticide use data collected in the past has been centered on agricultural commodities and the relationship to food and water safety. However, as emphasis on aggregate and cumulative exposure becomes increasingly more important, the need for pesticide use information in urban settings, particularly on lawns, increases as well. The last turfgrass pesticide use survey was conducted in 1992 and needs to be accurately updated.

- *Con dentiality*. Your responses will be strictly con dential. Only summary data from all survey participants will be included in the nal report.

- *How this information will be used.* Results of this survey will serve as a focal point to meet with commodity and user groups to develop Pest Management Strategic Plans and to discuss with these groups the current information on pesticide use, pesticide registrations, and pest management issues related to pesticide safety.

- *Incentive.* All individuals who return a completed survey will receive a copy of OSU Extension Bulletin L-187, Management of Turfgrass Pests. As an added incentive to encourage you to complete our survey, we will reward 50 participants through a random drawing from returned, completed surveys with a copy of a new turfgrass eld guide entitled, Turfgrass Problems: Picture Clues and Management Options.

- *Due Date.* Please return the completed survey on or before **February 22, 2002.**

On behalf of The Ohio State University Integrated Pest Management Program and Extension, thank you for taking the time to provide us with this important information. If you have any questions, please call me at 419-422-6106.

Sincerely,

Curtis E. Young, Ph.D.
Ohio State University Extension, IPM Extension Agent
NW District Of ce, Suite 202
1219 West Main Cross Street
Findlay, Ohio 45840

# Turfgrass Pesticide Usage Survey for Ohio 2001

**Survey Instructions:** We ask that the principal decision-maker of the business answer this survey. Please try to answer every question. Select or give the answers that you believe to be most true for your business. Answer questions by circling the letter or letters of choice or the number of choice. Complete the pesticide use table beginning on page two. Record the information for each material applied on a separate line.

1. **DID YOU APPLY ANY PESTICIDES TO TURFGRASS IN 2001? EXAMPLES: HERBICIDES, INSECTICIDES, FUNGICIDES, RODENTICIDES, PLANT GROWTH REGULATORS, INSECT GROWTH REGULATORS, ETC.**
   **(CIRCLE ONE)**

   A. Yes. *Go to question #2.*

   B. No.

*If your answer to this question is* **NO**, *you are nished. Thank you for your time. Please* **RETURN** *the survey in the self-addressed and stamped envelope without completing the remaining questions.*

2. **PLEASE IDENTIFY THE TURF AREAS RECEIVING PESTICIDE APPLICATIONS IN 2001 AND THE NUMBER OF SQ. FT. OR ACRES TREATED. (AN AREA MAY HAVE RECEIVED MULTIPLE APPLICATIONS, HOWEVER WHEN CALCULATING TOTAL SQ. FT. OR ACRES OF AREA TREATED, ONLY COUNT THIS AREA ONCE. FOR EXAMPLE, IF A 5,000 SQ. FT. LAWN RECEIVED THREE TREATMENTS, COUNT THE AREA AS 5,000 SQ. FT. NOT 15,000 SQ. FT.) (FILL IN THE BLANK FOR ALL THAT APPLY)**

| | Total Square Feet or Acres Treated |
|---|---|
| A. Golf Course (fairways, greens, tees, and roughs) | _____ |
| B. Residential Lawn | _____ |
| C. Commercial/Business Lawn | _____ |
| D. School Turf Areas and Athletic Fields | _____ |
| E. Public Turf/Park Areas* | _____ |
| F. Other, please list. | _____ |

*Street tree lawns, side walk tree areas, park lands

3. **USING INVENTORY OR PRODUCTION RECORDS FOR YOUR COMPANY, PLEASE LIST ALL PESTICIDE PRODUCTS USED ON TURFGRASS AND THE TOTAL AMOUNT OF THAT PRODUCT USED IN 2001.**

**Column 1** Record the **product trade name** and **formulation** of each pesticide product used on turfgrass in 2001. When entering product trade name, please be as complete as possible. Examples: ¤Trimec Plus Quadmec Post-emergent Grass & Broadleaf Herbicide, ¤Trimec Classic Brand Broadleaf Herbicide, ¤Trimec Classic Brand DSC Broadleaf Herbicide, Super Trimec¤ Broadleaf Herbicide, Deltagard¤ G Insecticide Granules, etc.

**Column 2** Record the **total undiluted amount of this product** applied in 2001. Show the units of measurement (lb, pt, qt, gal, oz, etc.) for each amount recorded.

**Ex 1:** Inventory or production records show that 4,130 lb of Dimension¤ 0.10% Plus Fer tilizer (Lesco 19-0-6 with Dimension¤) w ere used in 2001. On the rst line of the Table enter the following data: Column 1 - Dimension¤ 0.10% Plus Fer tilizer and Column 2 - 4,130 lb, see Line Ex 1 for data entry.

**Ex 2:** Inventory or production records show that 450 gal of Trimec¤ 899 Broadleaf Herbicide were used in 2001. On the second line of the Table enter the following data: Column 1 - Trimec¤ 899 Broadleaf Herbicide and Column 2 - 450 gal, see Line Ex 2 for data entry.

| Line # | Product(s) Applied to Turfgrass in 2001<br><br>*Enter complete product trade name and formulation.* | Total Undiluted Amount of This Product Used in 2001 |
|---|---|---|
| Ex 1 | Dimension® 0.10% Plus Fertilizer (Lesco 19-0-6 with Dimension®) | 4,310 lb |
| Ex 2 | Trimec® 899 Broadleaf Herbicide | 450 gal |
| 01 | | |
| 02 | | |
| 03 | | |
| 04 | | |
| 05 | | |
| 06 | | |
| 07 | | |
| 08 | | |
| 09 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |

4. **PLEASE GIVE AN EXAMPLE OF YOUR TYPICAL PRE-EMERGENT WEED CONTROL PROGRAM FOR RESIDENTIAL TURFGRASS USED IN 2001 (PRODUCTS & RATES OF APPLICATION). (WRITE IN ANSWER.)**

5. **PLEASE GIVE AN EXAMPLE OF YOUR TYPICAL BROADLEAF WEED CONTROL PROGRAM FOR RESIDENTIAL TURFGRASS USED IN 2001 (PRODUCTS & RATES OF APPLICATION). (WRITE IN ANSWER.)**

6. **PLEASE GIVE AN EXAMPLE OF YOUR TYPICAL INSECT/MITE CONTROL PROGRAM FOR RESIDENTIAL TURFGRASS USED IN 2001 (PRODUCTS & RATES OF APPLICATION). (WRITE IN ANSWER.)**

7. **IN YOUR STANDARD TURFGRASS PEST MANAGEMENT PROGRAMS, AT WHAT RATE WERE PESTICIDES APPLIED IN 2001? (CIRCLE ONE)**

   A. Always at less than the pesticide labeled rate.
   B. Sometimes at less than the pesticide labeled rate and at the pesticide labeled rate.
   C. Always at the pesticide labeled rate.
   D. Sometimes at more than the pesticide labeled rate and at the pesticide labeled rate.
   E. Always at more than the pesticide labeled rate.

8. **AT WHAT WIND VELOCITY WERE SPRAYED PESTICIDE APPLICATIONS STOPPED AND HOW WAS WIND VELOCITY DETERMINED? (CIRCLE ONE & FILL IN THE BLANK.)**

   A. 1 mph
   B. 5 mph
   C. 10 mph
   D. 15 mph
   E. 20 mph
   F. 25 mph
   G. 30 mph
   H. Did not stop applications based on wind velocity

**9. HOW OFTEN WAS PESTICIDE APPLICATION EQUIPMENT CALIBRATED? (CIRCLE ONE BESIDE EACH PIECE OF EQUIPMENT)**

| | | Times per Year | | | | | |
|---|---|---|---|---|---|---|---|
| A. Truck or Trailer Tank sprayers? | N/A* | 0 | 1 | 2 | 3 | 4 | 5 | More |
| B. Backpack sprayers? | N/A | 0 | 1 | 2 | 3 | 4 | 5 | More |
| C. Hand-pump sprayers? | N/A | 0 | 1 | 2 | 3 | 4 | 5 | More |
| D. Dry spreaders? | N/A | 0 | 1 | 2 | 3 | 4 | 5 | More |
| E. Other equipment?_____ | N/A | 0 | 1 | 2 | 3 | 4 | 5 | More |

***N/A = Not Applicable (do not have or use this type of equipment)**

**10. WHAT OTHER LAWN MAINTENANCE ACTIVITIES WERE PERFORMED IN 2001? (CIRCLE ALL THAT APPLY)**

A. Did not perform any other turfgrass maintenance activity.
B. Mowing
C. Renovation
D. Installation
E. Irrigation
F. Core aeration
G. De-thatching
H. Other, please list. _____

_____

**11. THE FOLLOWING LIST INCLUDES A VARIETY OF WAYS ONE COULD HAVE LEARNED ABOUT PESTICIDE APPLICATIONS. RATE HOW VALUABLE THE FOLLOWING SOURCES OF INFORMATION ARE WHEN USING PESTICIDES. (CIRCLE THE NUMBER OF CHOICE BESIDE EACH FACTOR)**

| Key | 1 = Not Valuable | 2 = Somewhat Valuable | 3 = Valuable |
|---|---|---|---|
| | 4 = Very Valuable | 5 = Extremely Valuable | |

| | | | | | |
|---|---|---|---|---|---|
| A. Individual consultation with pesticide/fertilizer dealer | 1 | 2 | 3 | 4 | 5 |
| B. Extension Service pesticide training sessions | 1 | 2 | 3 | 4 | 5 |
| C. Reading pesticide labels | 1 | 2 | 3 | 4 | 5 |
| D. Trade magazines | 1 | 2 | 3 | 4 | 5 |
| E. Commercial Newsletters | 1 | 2 | 3 | 4 | 5 |
| F. Buckeye Yard and Garden Line Newsletter | 1 | 2 | 3 | 4 | 5 |
| G. P.E.S.T. Newsletter | 1 | 2 | 3 | 4 | 5 |
| H. Extension Service Bulletins and Fact Sheets | 1 | 2 | 3 | 4 | 5 |
| I. Trade Shows/Field Days | 1 | 2 | 3 | 4 | 5 |
| J. Extension Service Field Days | 1 | 2 | 3 | 4 | 5 |
| K. Professional Conferences | 1 | 2 | 3 | 4 | 5 |
| L. The World Wide Web/Internet | 1 | 2 | 3 | 4 | 5 |
| M. Other (please specify) _____ | 1 | 2 | 3 | 4 | 5 |

*Please* **RETURN** *the survey in the enclosed self-addressed and stamped envelope OR send it to the address below. Thank you for your time and efforts.*

Curtis E. Young, OSU Extension, NW District, 1219 W. Main Cross St., Suite 202, Findlay, Ohio 45840-0702

## Turfgrass Pesticide Usage Survey for Ohio 2001 reminder postcard.

Curtis E. Young
OSU Extension, NW District
Suite 202
1219 West Main Cross Street
Findlay, Ohio 45840-2420

Dear Lawn Care Professional or Turfgrass Manager,

Earlier this month you should have received a copy of a survey entitled, Turfgrass Pesticide Usage Survey for Ohio 2001. This postcard is a reminder and an appeal for you to complete and return the survey as soon as possible. OSU Extension needs your input to be able to compile a clear and accurate summary of what kinds of pesticides and how much of these pesticides are used on turfgrass in Ohio. Since your input is critically important to this effort, we are extending the deadline for returning the survey to **March 15, 2001.** If you have not already completed and returned your survey, **please** consider doing so as soon as possible. If you have misplaced your copy of the survey, call me at **419-422-6106** and I will be more than happy to send to you a new copy. If you have already completed and returned your survey, **THANK YOU** for your time and efforts.

Sincerely,

Curtis E. Young

The Ohio State University
**Ohio Agricultural Research and Development Center**
1680 Madison Avenue
Wooster, Ohio 44691-4096
330-263-3700


**Ohio Agricultural Research and Development Center**

In Partnership With
**Ohio State University Extension**
**College of Food, Agricultural, and Environmental Sciences**